4125.1
427.100

1989 Pittsburgh Conference program Page 47

DECEMBER 5, 1988

CHEMICAL & ENGINEERING

NEWS

Community Relations

Chemical companies reach out to fight poor image Page 13

[illegible] K ARGONNE NL 1
[illegible] SERV-SRI
[illegible] SUITE 300
[illegible]

CHEMICAL & ENGINEERING
NEWS
Volume 66, Number 49
CENEAR 66 (49) 1–78
ISSN 0009-2347
DECEMBER 5, 1988

News of the Week

■ **The technical community is optimistic that President-elect Bush will lift the level of science advice in his Administration.** Page 4

■ **The first major U.S. patent in high-temperature superconductivity will be issued to MIT.** Page 5

■ **Six leaders of U.S. environmental groups meet with President-elect Bush to urge action on pressing environmental issues.** Page 5

■ **G. D. Searle says it will ask for a new trial in the Cu-7 contraceptive case as a result of allegations of jury misconduct.** Page 6

■ **Synthesis of gold-carbon species results from calculations based on relativity theory.** Page 6

Government

High indoor concentrations of volatile organic chemicals are found in EPA survey of 10 buildings. **Page 23**

Technology

Course on safe handling of genetically engineered organisms is latest effort of German chemical technology group DECHEMA to increase emphasis on biotechnology. **Page 31**

Education

Plight of physics literacy in high schools is underscored in study conducted by American Association of Physics Teachers. **Page 35**

Books

In **"Beyond the Laboratory: Scientists as Political Activists,"** Peter J. Kuznick ascribes political awakening to Great Depression, when scientific expansion was halted. **Page 36**

Meetings

1989 Pittsburgh Conference miniprogram includes symposium sessions, registration and other information. **Page 47**

Awards

ACS winners: Johnson, Allinger, Denmark, Fox, Knowles, Meinwald, Overman, Streitwieser, Trost, and Whitesides. **Page 55**

Cover: Dow Chemical researcher works with high school student in community program designed to stimulate interest in science careers

Letters 2

Concentrates

Business 7
Government 22
Science/Technology 30

The Departments

New Products 29
ACS Focus 44
ACS News 62
Newscripts 78

Business

More chemical company community relations programs must deal with community fears about the presence of chemical plants and possible harmful effects. **Page 13**

Chemical & Engineering News

1155—16th St., N.W., Washington, D.C. 20036

Editor: Michael Heylin
Assistant Managing Editors: David M. Kiefer, James H. Krieger, Janice R. Long, Donald J. Sorsson, William J. Storck. **News Editor:** Wilbert C. Lepkowski
Staff Editor: Ernest L. Carpenter
Senior Editors: New York: Earl V. Anderson, Stephen C. Stinson; Chicago: Joseph Haggin; Washington: Doron Dagani, Lois R. Ember, Rebecca L. Rawls, Pamela S. Zurer
Associate Editors: Stuart A. Borman, Mairin B. Brennan, Bette Hileman, Richard J. Seltzer
Service Departments Editor: Dolores Miner
Editing Services: Anne Riesberg (Head), Arlene Goldberg-Gist (Editorial Assistant), Patricia Oates (Administrative Assistant)
News Bureaus: Northeast News Bureau: (201) 906-8300 Marc S. Reisch (Assistant Editor), Ann M. Thayer (Assistant Editor), Rachel Eskenazi (Administrative Assistant). Chicago: (312) 256-4143 Ward Worthy (Head). Houston: (713) 973-8161 Bruce F. Greek (Head). Washington: (202) 872-4495 David J. Hanson (Head). West Coast: (415) 653-3630 Rudy M. Baum (Head). **Foreign Bureau:** London: (01) 540-0414 Dermot A. O'Sullivan (Head). Patricia L. Layman (Associate Editor)
Graphics and Production: Leroy Corcoran (Manager). Alan Kahan (Art Director). Barbara Fryer (Production Art Director). Linda Mattingly (Staff Artist). Diane Kelly (Costing). **Business Manager:** Arthur Poulos
Circulation Development: Claud K. Robinson

ADVISORY BOARD: William J. Bailey, Jacqueline K. Barton, Ernest H. Drew, Harry G. Drickamer, A. Nicholas Filippello, Vincent L. Gregory Jr., Adam Heller, John D. Holmfeld, Isabella Karle, Koji Nakanishi, Richard Nicholson, Howard A. Schneiderman, Ellen K. Silbergeld, Howard E. Simmons, Robert M. Simon, William P. Slichter

Published by
AMERICAN CHEMICAL SOCIETY
(202) 872-4600; TDD (202) 872-8733
John K. Crum, Executive Director

PUBLISHING BOARD: Ned D. Heindel (*Chairman, Board of Directors Chairman*), Ernest L. Eliel, *President*; Gordon L. Nelson, John H. Nelson, Louis D. Quin, Jeanne M. Shreeve, and Barbara G. Wood

© Copyright 1988, American Chemical Society

Subscription & Member Record Service: Send all new and renewal subscriptions with payments to: Controller, ACS, P.O. Box 28597, Central Station, Washington, D.C. 20005. Correspondence and telephone calls for changes of address, claims for missing issues, subscription service, status of records and accounts should be directed to: Manager, Membership & Subscription Services, ACS, P.O. Box 3337, Columbus, Ohio 43210; (614) 421-3776.

For changes of address, include both old and new addresses with ZIP code numbers and mailing label from a recent issue. Allow four weeks for change to become effective. Claims for missing numbers will not be allowed if loss was due to failure of notice of change of address to be received in the time specified; if claim is dated (a) North America: more than 90 days beyond issue date; (b) all other foreign: more than one year beyond issue date; or if the reason given is "missing from files."

Subscription Rates 1988. Printed editions: nonmembers U.S. 1 yr. $49, 2 yr. $83, outside U.S. 1 yr. $75, 2 yr. $135. Air freight rates available on request. Rates above do not apply to nonmember subscribers in Japan, who must enter subscription orders with Maruzen Co. Ltd., 3-10 Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan. Tel: (03) 272-7211. Single copies: Current $7.00. Rates for back issues and volumes are available from Microforms & Back Issues Office, ACS, 1155—16th St., N.W., Washington, D.C. 20036. Back and current issues available on microfilm and microfiche. Rates on request from Microform Program, ACS.

Chemical & Engineering News (ISSN 0009-2347) is published weekly except for the last week in December by the American Chemical Society at 1155—16th St., N.W., Washington, D.C. 20036. Second-class postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to Chemical & Engineering News, Membership & Subscription Services, P.O. Box 3337, Columbus, Ohio 43210. ACS assumes no responsibility for the statements and opinions advanced by the contributors to its publications.

Advertising Management
CENTCOM LTD.
(For list of offices see page 77)

LETTERS

Human side of science

SIR: There will no doubt be criticism of Rudy Baum's review (C&EN, Oct. 31, page 42) of Sheldon Glashow's "Interactions: A Journey Through the Mind of a Particle Physicist and the Matter of This World."

We chemists, despite our protests to the contrary, are an emotionally neutral group. We allow the human side of science to be revealed only in metered, piecemeal fashion. What Baum has presented to us is the whole picture: the science, the presentation, and the author, as revealed by the author's words. Compare this style with the endless droning on scientific details that some reviewers find so comforting.

Baum's article should be made required reading for all C&EN book reviewers.

David E. Hughes
Alternate Councilor
ACS Norwich Section
Norwich, N.Y.

Chemistry of Stradivarius

SIR: I would like to respond to one of the letters prompted by my article on the chemistry of Stradivarius. In his comments (C&EN, Oct. 17, page 3), W. L. Stanley assigned more guilt and responsibility to me than I can possibly bear.

My special report (C&EN, May 23, page 24) does not say anywhere that chitin was used by the Cremona violin makers, who have already been credited with too many deep insights. The use of partially deacetylated chitin for acoustical purposes was clearly my own invention as it was described in two articles written for the premier journal of violin making [*J. Violin Soc. Amer.*, **6**(2), 53 (1980) and **6**(3), 19 (1983)].

More serious is the notion, also advanced by Stanley, that I may be held responsible for some violin varnishes that look like oatmeal cookies when, in fact, my own varnish has the appealing look of a candied apple. I must ruefully admit that I did advocate the use of Mount St. Helen's volcanic ash as a filler in my 1980 article. However, it is my educated guess as an oatmeal consumer that the brown pozzolana ash, which was first recommended by J. Chipura in *Strad* magazine in 1984, may be the culprit involved. This clay-rich soil is inherently opaque, which may limit its uses to the larger and cheaper instruments.

Naturally, there are many valuable skills involved, but the current renaissance of violin making would be unthinkable without the vigorous participation of chemists and materials scientists. The apple remains the prerequisite of the apple pie.

Joseph Nagyvary
Professor
Texas A&M University

Politics and chemists

SIR: I was gratified by your coverage of Rep. George Brown's remarks at the ACS national meeting in Los Angeles on more political activity by chemists (C&EN, Oct. 3, page 10). I have been active in partisan politics for most of my adult life, and my greatest frustrations are experienced when talking to other chemists. Not only are scientists too shy about taking public stances on political issues, most are reluctant to get even minimally involved in elective politics.

Unfortunately, over the past 30 years or so, partisan politics have become anathema to many professional people, not just scientists. The reasons for this can be discussed, perhaps even understood, but some important implications of this attitude should be pointed out.

Many scientists of my acquaintance who have registered to vote (and far too many have not) list themselves as "unaffiliated" and think that makes them "independent." On the contrary, in most states these voters are completely dependent on activists in the two major parties to choose the nominees for political office at every level, from county sheriff to President of the U.S. I thus have little patience with educated people who complain about the quality of the candidates when they have made no effort to help choose those candidates.

I urge my fellow ACS members to get involved in the full electoral process, including state and local politics. State legislators, county commissioners, and others are frequently confronted with technical issues that they do not understand. There is no better way to get an elected official's attention after the election than to have worked on his or her campaign. Moreover, you might be pleasantly surprised to learn that your credibility has been enhanced, even if your candidate is defeated! At the very least, you will gain a better appreciation of the political realities of the technological issues you care about.

It is usually argued that a scientist's objectivity would be compromised by such activity. This could be true in a few

Survey Finds High Indoor Levels Of Volatile Organic Chemicals

EPA monitoring study focuses attention on current need for increased research funding to better understand indoor air quality problems

Lois R. Ember, C&EN Washington

People are exposed to much higher levels of dangerous air pollutants in office buildings, schools, hospitals, and nursing homes than outdoors, even in heavily industrialized cities, the Environmental Protection Agency says. But by legislative fluke, neither EPA nor any other agency is charged with regulating indoor air quality.

A five-year, $850,000 study by EPA, the first of its kind, found more than 500 volatile organic compounds (VOCs), most only once, in a survey of 10 buildings. Indoor concentrations for all compounds except benzene exceeded outdoor levels, clearly indicating indoor sources. Aliphatic hydrocarbons were the compounds found most frequently, followed by aromatic hydrocarbons and chlorinated hydrocarbons.

New buildings were found to have very high concentrations of aromatic and aliphatic hydrocarbons immediately after completion. Over the next several months, concentrations dropped rapidly, sometimes by an order of magnitude. Occasionally it took up to a year for indoor concentrations to drop to the concentration of the same pollutants outdoors. Recognizing this, Scandinavian countries require 100% outdoor air as makeup air for the first six months of a building's existence.

Though EPA's study supports the need for the Scandinavian practice, the agency has not set such a standard. As Lance A. Wallace of EPA's Office of Research & Development and the project officer on the 10-building monitoring study explains, "We have the data but we don't have the authority." Robert B. Axelrad, director of EPA's indoor air division, confirms this. "At this point, we don't believe we have any legislative authority to do that. We can't regulate under the Clean Air Act." The agency confines its efforts to regulating ambient air, which, in 1970, it defined as air external to buildings.

In the 10-building monitoring effort, EPA researchers tracked the VOCs to common items: building materials, cleaning solvents, furnishings, and pesticides. Latex caulk, carpet adhesive, latex paint, telephone cable, carpeting, and particle board were some of the highest emitters of VOCs. With the thrust to tighter, more energy efficient buildings, these compounds can build up to very high concentrations.

Most people spend nearly 90% of their time indoors, and for this reason are potentially at greater risk of developing health problems from breathing indoor air than from outdoor air. And those spending the most time indoors—the very young, the very old, and the chronically ill—are potentially the most susceptible to such adverse effects as headaches, depression, fatigue, irri-

Myriad organic compounds typically found indoors

Aromatic hydrocarbons
Benzene
Diethylbenzenes
Dimethylethylbenzenes
Ethylbenzene
Ethylmethylbenzenes
Methylnaphthalenes
1-Propylbenzene
Naphthalene
Propylmethylbenzenes
Styrene
Toluene
Trimethylbenzenes
Xylenes

Halogenated hydrocarbons
Chloroform
Dichlorobenzenes
Dichloromethane
Tetrachloroethylene
1,1,1-Trichloroethane
Trichloroethylene
Trichlorofluoromethane

Alcohols
2-Butyloctanol
1-Dodecanol
2-Ethyl-1-hexanol
1-Hexanol

Esters
Ethyl acetate
1-Hexyl butanoate

Aliphatics
Cyclohexane
Decane
Dodecane
2,4-Dimethylhexane
1,3-Dimethylcyclopentane
Eicosane
Heptane
Hexane
Methylcyclohexane
4-Methyldecane
2-Methylheptane
2-Methylhexane
3-Methylhexane
3-Methylnonane
2-Methylpentane
3-Methylpentane
Nonane
Octane
Pentadecane
Pentane
Tetradecane
Tridecane
Undecane

Aldehydes
Decanal
Nonanal

Miscellaneous
Acetic acid
Acetone
Dimethylphenols
Ethylene oxide

Source: Environmental Protection Agency

tability, allergylike symptoms, heart disease, and cancer.

In some new buildings xylenes and decane, chemicals associated with the so-called "sick building syndrome," were found in concentrations 100 times greater than outdoor levels. According to Axelrad, the sick building syndrome is "a collection of symptoms for which a cause has not been identified." The potential causes include chemicals (very low levels of VOCs) as well as biological agents such as bacteria and fungi. Many people in sick buildings, including EPA's own headquarters building, claim to have become chemically sensitive, though there is no clinically acceptable test for chemical sensitivity. Many cite allergylike symptoms, which seems to implicate biological agents.

Congress began to focus its concern about indoor air quality in 1982 when it mandated that EPA define the problem by monitoring air quality in buildings. Because EPA failed to budget for a monitoring effort, Congress, by line item, appropriated about $500,000 for the 10-building study for the years 1982 and 1983. In 1984 and 1985, Congress upped the line item sum to $2 million. This larger amount, however, also covered other related research efforts such as looking at kerosene heaters and gas stoves as pollutant sources. By 1985, EPA began to put money for indoor air quality research into its budget request.

So far, Congress has pegged all resources for research and none for regulation. Neither Congress nor the Administration has shown any inclination to regulate the indoor air quality of public buildings. And, in fact, no one in EPA familiar with the problem feels that enough is known at this time to introduce a command-control regime for indoor air.

Additional studies are needed on the health risks to people exposed to low levels of a mixture of chemicals, EPA's Wallace says. As Axelrad explains, "We need more research to decide what's safe." Some of the VOCs found in buildings are cancer-causing compounds. EPA doesn't recognize a safe level for a carcinogen. But it does set action levels for some indoor pollutants. Radon is one example.

Until 1982, EPA had little if any expertise in the area of indoor air quality. Most of the expertise in building and ventilation systems rested with the Department of Energy. With the 1970s oil crisis, energy efficiency became the watchword, and buildings became more airtight. With less air exchange, DOE recognized that pollutants could build up indoors and so the agency began to study the problem. DOE, however, has no authority to regulate in this area.

EPA is now looking for its appropriate role. Axelrad, who directs the policy side of the indoor air program, says EPA can continue to research the problem, and develop and disseminate information to the public as it becomes available. Or the agency can take a command-control approach—that is, regulate.

At the moment EPA is opting for the former role for several reasons. Many in the agency feel that substantially more funding must go into researching the health risks and mitigation strategies for the mix of chemicals found indoors. Standard setting on a pollutant-by-pollutant basis, as has been done for ambient air, is not an effective way to improve indoor air quality, they claim. Putting out information to give the public guidance is a more meaningful approach now, they say, than trying to issue fruitless regulations.

So along with the release of the 10-building study, the agency distributed two booklets. One, a "Directory of State Indoor Air Contacts," is a 129-page listing of state agency contacts for 16 indoor air-related issues. The second, a 32-page booklet entitled "The Inside Story—A Guide to Indoor Air Quality," describes the sources of pollutants, how to control them, and the health risks associated with them.

This latter booklet offers three strategies for taming the problem: source control, improved ventilation, and the use of air cleaners. EPA has "done little on the health effects of very low levels of pollutants and on mitigation technologies," Axelrad says. "There is certainly a need for a significantly expanded program to evaluate air-cleaning technologies and other mitigation strategies," he adds.

David Hawkins, senior attorney with the Natural Resources Defense Fund and former EPA administrator for air programs, says EPA can begin to do several things immediately. "First, the agency can without delay begin to deliberate with authorities that set building standards. Also the agency can begin advocating within the Administration for more resources," he says.

"EPA would have a strong case for setting standards for new buildings," Hawkins claims. And if President-elect George Bush's campaign promises mean anything, EPA probably will be getting higher levels of funding under his Administration, which means more money for indoor air programs, he reasons. "Bush set himself up to deliver in environmental areas. Whatever the flexible freeze means, it must apply in those areas of the campaign he stressed and the environmental area is one such area," Hawkins says.

EPA is monitoring the activities of ASHRAE, the American Society of Heating, Refrigeration & Air Conditioning Engineers. ASHRAE, a standard-setting organization that sets guidelines for building contractors, has in the past issued a standard that would give every person 5 cu ft of fresh air per minute. The organization is now revising this code to 15 cu ft per minute per person.

Axelrad says this revision is "a comfort standard, not a safety standard. But it is the only thing available that the building community has in the way of guidance."

The agency is looking at ventilation strategies and at indicator levels such as total VOCs as ways of approaching the indoor air quality problem. But EPA has neither the authority nor the desire to set ventilation or VOC standards.

A staff member on Rep. James H. Scheuer's Subcommittee on Health & the Environment of the Energy & Commerce Committee applauds EPA's monitoring study. "It's the first time any regulatory agency has gone out to look at public buildings in any methodical way. EPA's study raises new concerns about the level of VOCs that seem to be released in new office buildings," he says.

Rep. Scheuer (D.-N.Y.), who held hearings this year on indoor air

Indoor concentrations of volatile organics in new buildings greater than outdoor levels

Nanograms per liter	Aromatic hydrocarbons			Aliphatic hydrocarbons			Chlorinated hydrocarbons			Oxygenated hydrocarbons			Total		
	Indoor	Outdoor	Indoor/ outdoor ratio	Indoor	Outdoor	Indoor/ outdoor ratio	Indoor	Outdoor	Indoor/ outdoor ratio	Indoor	Outdoor	Indoor/ outdoor ratio	Indoor	Outdoor	Indoor/ outdoor ratio
New hospital															
34 weeks old	18	5.4	3.3	7.0	nd	nc	8.1	3.7	2.2	1.3	nd	nc	34	9.1	3.7
48 weeks old	11	5.1	2.2	4.7	nd	nc	6.0	5.3	1.1	nd	nd	nc	21	10	2.1
1½ years old	26	6.2	4.2	5.1	nd	nc	26	3.2	8.1	nd	nd	nc	57	9.4	6.1
New office building															
1 week old	270	16	17	810	nd	nc	13	1	13	nd	nd	nc	1100	17	65
14 weeks old	54	13	4.2	98	nd	nc	56	3	19	8.5	nd	nc	220	16	14
New nursing home															
4 weeks old	93	8.5	11	173	nd	nc	9.9	2.8	3.5	9.6	nd	nc	286	11	26
23 weeks old	22	17	1.3	7.3	nd	nc	3.9	2.5	1.6	1.2	nd	nc	34	20	1.7

Note: Building ages are approximate. nd = not detectable (below quantifiable limit), nc = not calculated. **Source:** Environmental Protection Agency

quality, says, "Indoor air will be a high priority for my committee next year." His aide says that "with a new Administration, we might be able to make some progress in this area."

Another House member active in promoting indoor air quality programs is Rhode Island Republican Rep. Claudine Schneider. EPA made certain that she received copies of the two booklets and the 10-building monitoring study. However, at press time Michael Totten, the legislative aide covering the issue for the Representative, had "not had a chance to review the material."

As Scheuer indicates, the issue is not going to die. Come early next year, EPA will present Congress with the indoor air quality report mandated by Superfund. Under the revised Superfund law, the report was to be coordinated by EPA but was to outline governmentwide activities in the area of indoor air quality.

The deadline for submitting this report to Congress was October 1988, but the press of other business has kept EPA behind schedule. At the moment the report is undergoing internal review.

As it now stands the report is in three volumes. The first outlines all federal indoor air activities. The second enumerates assessment and control technologies. And the third documents research needs. According to EPA sources, the agency is also putting together a primer on indoor air quality that will be submitted as a separate volume.

While EPA was coordinating the report to Congress, the agency and the National Institute for Occupational Safety & Health (NIOSH) were busy tackling the sick building syndrome within the federal complex. Workers at the fairly new Madison Building of the Library of Congress have complained of ill health effects, which they believe are caused by microbial aerosols.

Harriet A. Burge, associate research scientist at the University of Michigan Medical School, under contract to NIOSH, focused her monitoring effort on biological aerosols—fungus, mold, bacteria—not on volatile organic chemicals. She sampled the building for three days in the summer and found normal microbial levels. But she says the conditions were not ideal for finding high levels of biological aerosols, if they are present. "I didn't detect anything I would consider contamination," she says, "but you can't interpret my data set until winter samples are taken." Because of the presence of books, circulating air in winter is humidified. That being the case, she has said that if abnormal levels are to be found, their possible source might be air washers in the air handling units. Burge believes that next year NIOSH will be conducting a written survey and DOE will be taking ventilation samples.

At EPA headquarters, VOCs were the focus of another monitoring effort. One of the buildings was undergoing renovation. Some EPA employees became acutely distressed upon entering these renovated quarters. A monitoring study found hundreds of VOCs, but at extremely low levels. Because new carpeting had been laid, scientists looked for 4-phenylcyclohexene. Not surprisingly, this odorous compound, the product of the reaction of styrene and butadiene found in the backing of new carpeting, was detected at about 1 ppb.

None of the chemicals was found at a high enough level to be fingered as the culprit. But the health effects noted by some workers could have been caused by the mixture of chemicals found. An early 1980s study determined that people breathing a mixture of 22 compounds, all present at low levels, were unable to concentrate and suffered memory loss. The total concentration of the 22 compounds was 5000 ng per L, a VOC concentration found in some so-called sick buildings. EPA is now replicating this study.

Because EPA's headquarters monitoring effort was inconclusive, the agency is planning to conduct a written survey this January. All workers in EPA's three headquarters buildings will be asked to describe their health symptoms.

The agency is on the upward slope of a steep learning curve. As Wallace explains, "EPA has never dealt with a sick building." □